

Introduction

Gel coat makes fiberglass reinforced products attractive and practical. Technically, it is a surface coating of pigmented polyester resin which gels against the mold surface and cures with the structural laminate. It faithfully reproduces the mold surface, imparts color, and protects the reinforcing fibers from external elements. In many cases, the surface treated with gel coat is the only part of the structure that can be seen. To the user, it is simply a reinforced plastic. Resins, fillers, pigments and promoters are carefully selected and formulated to develop the quality and surface appearance needed to make the product durable and saleable. Customer acceptance of the product can depend entirely upon the care and handling of gel coat.

Several key points must be considered if the gel coat surface is to perform to its capabilities:

- Gel coat make-up and realistic performance expectations.
- Proper equipment, suitable for the specific application.
- Skill of the spray operator: proper training and experience.
- General spray methods.
- Special spray methods for specific parts according to size and shape.
- Problems and solutions.

The various components of the gel coat system influence the quality and working properties needed to provide the performance characteristics for the intended end use.

The Resin: The basic ingredient of gel coat is the polyester resin system, which provides the chemical composition that determines the chemical and physical properties of the gel coat.

Orthophthalic: Orthophthalic anhydride is used in general purpose resins where superior (anhydride or

acid) resistance to water and chemicals are not of prime importance. For years it has been one of the raw materials incorporated into polyester resins and is still available but is often replaced by the more durable isophthalic types of resins.

Isophthalic: Reacted into the resin, isophthalic acid provides greater levels of water (acid) and chemical resistance than does orthophthalic anhydride. This is especially important in the manufacture of boats, shower and bath enclosures. Greater chemical, weather and corrosion resistance with a higher degree of flexibility are the immediate benefits when isophthalic acid replaces orthophthalic acid in the resin.

Neopentyl Glycol: When the highest possible quality and performance levels are required, neopentyl glycol is reacted into the isophthalic resin in the proper mole ratio. This raw material can produce weathering and chemical resistance capabilities superior to resins formulated with other common glycols.

Pigments: Pigments and their quality determine both the color we see and the color integrity, which simply means the ability of the color to resist change from exposure to various environments.

Extenders/Fillers: Extenders provide the gel coat with proper spraying characteristics and influence the cured physical properties.

Thixotrope: Most of the viscosity comes from the thixotrope. Its purpose is to hold the gel coat on a vertical surface, yet allow easy breakup for good spraying properties.

Accelerators/Promoters: Regulate gel and cure characteristics of the gel coat. Peroxide initiates the gel coat cure. Although commonly referred to as catalysts, peroxides are initiators.

Spray Equipment Selection and Operation

The quality and appearance of every part depends upon the gel coat, the type of application equipment used and the skill of the operator. It is critical that each of these components be given careful consideration prior to application or the resulting finish may be less than satisfactory. This section will present the major type of spray equipment recommended for standard gel coat applications. Because this guide cannot provide precise specifications for every individual application, it is intended to aid generally in the selection of proper spray equipment. The exact spray equipment and settings for a particular operation will depend on the plant lay-out, production rate, configuration of the parts to be coated and the spray operator.

DETERMINING NEEDS AND CONDITIONS

Before deciding on the appropriate spray system, attention must be given to the nature and number of parts to be sprayed and the location in the plant of the spray operation. Major consideration should be given to the following:

- Determine all safety procedures and equipment necessary before beginning the operation.
- Allow for increased production and adaptability to a variety of operations
- Determine time and labor involved for set-up and clean-up.
- Determine if parts to be sprayed are simple, complex, large, small, flat or curved.
- Determine the number of colors to be sprayed.
- Determine number of parts to be sprayed and whether they will be coated at regular intervals or at random.
- Thoroughly evaluate your maintenance program to determine if it should be supplemented to sufficiently protect your investment.

By a thorough analysis of the nature of the operation, you can determine which spray equipment described below will best meet your needs.

TYPES OF SPRAY EQUIPMENT

Comparison of spray equipment types can be based on three major considerations: How the material is delivered to the gun, how the catalyst is added and finally, how the gel coat is atomized.

ADDITION OF THE CATALYST

"Hot Pot" System

In this system, a measured amount of catalyst is stirred by hand directly into a container (pressure pot) which is then sprayed from a pressure feed tank within the allowable gel time period. This is currently the most accurate system but uses a large quantity of clean-up solvent and any unforeseen delays can lead to lost hoses and a difficult cleaning job. This system should not be used for continuous production due to waste and safety reasons.

Catalyst Injection System

Many Gel coat applications today use the catalyst injection system, especially for high production fabrication. It permits uninterrupted spraying. In this system, the liquid catalyst is injected into the atomizing air supply by an adjustable venturi device with a flow meter. The ball settings of the catalyst flow meter are translatable into cubic centimeters or grams per minute so the catalyst feed can be matched to the measured weight output of Gel coat per minute and ratio established. As the output of the gun changes, e.g., change of tip or change of pump pressure, the catalyst delivery rate must also be adjusted to maintain the proper ratio and assure the scheduled performance of the gel coat in gel and cure time.

Spray Equipment Selection and Operation (Cont.)

ATOMIZATION OF GEL COAT

Airless Spray System

Airless spraying equipment for gel coat application is the most popular today. Advantages include better film leveling at high delivery rates and elimination of blow-back when spraying in closed areas. In a typical airless system, the gel coat never comes into direct contact with compressed air and is not broken up by air. Instead, an air-activated high ratio pump (usually 33 to 1) puts the gel coat under high pressure (1000-3000 psi.) by forcing it through a small orifice (.015-.026 in.). The high velocity fluid impacts with ambient air at the orifice and breaks up due to the sudden and extreme pressure differential. The typical airless system uses the air-activated pump to feed the nozzle which delivers the gel coat spray. A catalyst nozzle is located next to the fluid nozzle and delivers a catalyst spray which mixes by implosion into the gel coat fan. Airless systems are used primarily for coating large, basically open or flat parts.

Air Atomized System

In this system, the gel coat is broken up by direct contact with an air system pressure of 70 - 90 psi. The material break-up and delivery can be accomplished by two methods.

1. Internal Mix: The gel coat and initiator combine within the spray gun head and are forced through a single orifice. The internal mix

tends to cause porosity and rougher finish, and requires a flushing system to keep material from hardening in the mixing head. This method is not suitable for most gel coat operations and is, therefore, not recommended.

2. External Mix-Atomized System

Stage One

The annular ring around the fluid nozzle tip emits an envelope of pressurized air which immediately surrounds the fluid stream being sprayed through the tip. This instant contact breaks up or coarsely atomizes the gel coat with the air.

Stage Two

Two converging streams of air forced from air holes located on either side of the annular ring intersect the fluid stream to further break it down resulting in a finer atomization. Two straight contaminant holes indexed at 90 keep the stream from fanning out.

Stage Three

Right after second stage atomization, side port air jets are emitted from passageways within the angular projections on the nozzle (often referred to as wings, ears or horns). Catalyst is injected into the above air stream by an independent catalyst injection system.

Efficient Use of the Spray Gun

For the most efficient use of the gun, always make a careful check that all parts are the proper size and type, and are in perfect working order before operating. The following items can serve as a checklist:

Manifolds and Regulators: The CFM capacity should be at least one and one half (1.5) times the total capacity required by the equipment. A separate regulator should control the atomizing air and all gauges should be readable and in good working condition.

Moisture and Oil Traps: In order to assure the least amount of contamination of the Gel coat, moisture and oil traps should be installed and drained daily (minimum) on all air lines at the spray booth. Traps must be installed on the lines at least 25 feet away from the air compressor.

Quick Disconnects: Quick disconnects are not recommended for airless or high pressure systems, and may reduce the volume of air and fluids passing through them. If they are used, they should be the largest size available.

Hoses: Hoses are used only for delivering air from a regulator on a main air line and fluids from the fluid pump to the gun. The standard hose length is 25 feet and should never exceed 50 feet. Hose capacity should match the volume delivery and pressure demanded by the gun when the trigger is pulled. Hoses must be capable of delivering the material at the volume and pressure rates dictated by the gun. There will always be a pressure drop from one end of the hose to the other.

CAUTION: Construction materials for airless hoses and catalysts must be compatible. Always consult manufacturer's recommendations for proper hose.

	Pounds of Pressure		
	60 lbs.	70 lbs.	80 lbs.
1/4" Inside Hose Diameter	Air Pressure Drop at Gun		
20' Hose	16-3/4	19-1/2	31
25' Hose	19	22-1/2	34
50' Hose	31	34	37
5/16" Inside Hose Diameter	Air Pressure Drop at Gun		
20' Hose	5-1/2	6-3/4	8
25' Hose	6	7-1/4	8-3/4
50' Hose	11-1/2	13	14-1/2

PLANT AIR SUPPLY

The plant's main air lines should be steel pipe, as large in diameter as possible and designed for compressed air.

Adequate compressor capacity is required to supply enough air volume and pressure to run every piece of air powered equipment in the plant at the same time. Pipes should be laid out as straight, and with as few fittings, as possible. Drop lines should come off the top of main air lines. Lines should slant slightly to drain off any accumulated water. Air lines should be located off drop lines at least 12 inches from the end with a drain valve installed on the bottom. It is desirable for the molding line to have its own air supply.

Spray Gun Maintenance

The spray gun and support equipment represent a substantial dollar investment. The best method of protecting that investment is a planned maintenance program which should include a supply of spare parts and daily maintenance checks.

RECOMMENDED SPARE PARTS FOR EACH GUN

- Air nozzle, needle and tips
- Packing and gaskets
- Hoses and fittings
- Gauges
- Proper lubricants
- Filter screens
- Diaphragms for pressure regulators

RECOMMENDED EQUIPMENT MAINTENANCE

Daily clean-up all parts with proper cleaners/solvents. Re-lubricate where lubricant is washed away by cleaning. Moisture traps and compressor tanks must be drained daily.

CALIBRATION

Catalyst injection spray equipment must be calibrated as polyester resins require the addition of exact amounts of catalyst for working and production requirements in order to attain their proper physical and chemical properties. One of the most important keys to successful Gel coat application is making sure that spray equipment is operating at the proper catalyst to Gel coat ratio. In order to stay within the proper working range, calibration of the spray equipment is necessary. Calibration of any dual feed spray gun follows the same basic procedures. Set the Gel coat for proper flow rate and atomization, then adjust the catalyst for the proper delivery rate (ratio of catalyst to Gel coat).

CALIBRATION PROCEDURES FOR AIRLESS AUTOMATION

1. Before starting the calibration procedure, make sure that adequate safety precautions are observed.

2. Make sure all air to gun and catalyst pots are turned off, hose connections are tight and that the gun is grounded. The gun should not be pointed at yourself or anyone else at anytime.

3. Be sure that all mechanical parts of the gun are in good working condition; clean and lubricate where necessary. Filters, screens and tips should be clean and air regulators backed out to zero pressure.

4. Once the proper tip is installed, the air should be turned on and the air motor regulator adjusted until good break-up is observed and no tails are present in the fan.

5. A 12-inch piece of rubber hose should be placed over the gel coat tip and sprayed into a previously weighed container for 15 seconds. The material should be weighed (don't forget to subtract the weight of the container) and multiplied by 4. If weight is in grams, divide by 454. This gives you pounds per minute.

6. Air supply to gel coat spray air motor should be turned off and the gun triggered to relieve remaining pressure.

7. It is important to make sure the catalyst pot is full and in good working order. The flow rate of the catalyst should be set according to manufacturer's instructions. The ideal catalyst setting is in the range of 1.5 - 2.0% MEKP.

8. Flow Rate in grams per minute X (Desired Percent Catalyst) = Grams per minute of 100catalyst needed. When working with diluted catalyst, a dilution factor must be included in the calculation.

- 100 grams at 1:1 dilution contains 50 grams of catalyst
- 100 grams at 2:1 dilution contains 33.3 grams of catalyst

Spray Gun Maintenance (Cont.)

- 100 grams at 3:1 dilution contains 25.0 grams of catalyst
- For 100 grams of catalyst using a 1:1 dilution, 200 grams of solution are needed.
- For 100 grams of catalyst using a 2:1 dilution, 300 grams of solution are needed.
- For 100 grams of catalyst using a 3:1 dilution, 400 grams of solution are needed.

9. Once flow rate is set, a clean 12' hose should be connected to the catalyst tip and sprayed for 30 seconds into a pre-weighed container. Catalyst weight X 2 is flow rate (grams) per minute of catalyst.

10. Once catalyst and gel coat rates are set, the ball setting on the catalyst should be noted and the number of pump strokes per minute counted. These parameters are useful for noting any deviations in calibration but are not a substitute for the calibration procedure.

CALIBRATING AIR-ATOMIZED EQUIPMENT

For calibration of an air-atomized system, the same principles apply as for airless spray calibration. The

gun is set for the desired delivery rate and proper atomization, then the catalyst delivery system is set so that the proper amount of catalyst is delivered.

1. Make sure air supply to the equipment is clean and free of oil, water or rust. The gun and catalyst delivery system should be clean and in good working order.

2. With catalyst delivery and atomization air off, the pump or pot pressure should be adjusted to deliver desired flow rate of material. Collect in a weighed container for 15 seconds and calculate delivery rate. See Procedure 5 above.

3. The desired catalyst flow rate should be calculated and the delivery rate set. The delivery rate should be verified by collecting and weighing the catalyst as described in Procedures 8 and 9 above. Actual collecting and weighing of catalyst is not practical for some pieces of equipment. Catalyst should be set according to recommended ball settings and verified by spraying material on a piece of cardboard, collecting some in a cup and measuring gel time.

Gel Coat Repair

Regardless of the care taken in producing fiberglass reinforced parts, some of them will require repair. Defects are caused by operator error, defects in the mold, contamination, rough de-molding and impact and abrasion during assembly, handling, and storage.

When a defect is discovered, determine and eliminate the cause so that it is not repeated in the production of subsequent parts. Next, determine which of the three major repair types fit the defect: marred or slightly scratched area; deep defects which require routing; or damage to the laminate behind the gel coat.

MARRED OR SCRATCHED AREAS

Steps

1. Wet-sand the damaged area using a good quality 320 grit sandpaper followed by successively finer grits ending with 600. Use a sanding block when applicable and always sand in the same direction.

CAUTION: Use 320 grit only when the defective area is deep. Minor scratches can be rubbed out with 400 grit followed by 600 grit or rubbing compound.

2. Wash sanded area with clean acetone. Be sure it is completely free of sanding dust and grit both during and when the sanding operation is completed.

3. Use a good quality rubbing compound and buffer to polish sanded area. It is advisable to use a white or translucent compound especially with white or pastel colored finishes. Use liberal amounts of compound, minimal pressure and keep buffer moving to prevent heat buildup.

4. When the surface appears to have a dull gloss, use a polishing compound to bring the gloss close to the original gloss.

5. Wash compounded and polished area with clean acetone.

6. Apply an even coat of paste wax and hand buff.

DEEPER DEFECTS - ROUTING

Steps

1. Grind out the defective area with a sharp routing tool. Do not leave any undercut edges. Feather in the defective area.

2. Sand entire defective area with 280 grit dry sandpaper, feathering in the edges. Use an air hose to blow out the dust.

3. Wash area with clean acetone.

4. Catalyst and mix the gel coat to repair defective area. (Epoxy putty may be preferred especially if damaged area is in hull or area below water line.) A reinforced putty can be used to fill in areas where there is a deep defect (more than 30 mils) which does not affect the laminate strength. Follow with a patch. For reinforced putty, mix 10% filler-milled glass fibers, 1% thixotrope to resin or gel coat. Mix well until obtaining smooth, paste-like consistency. Then catalyze, fill, allow to cure and sand for spray patch.

CAUTION: Use the same production batch of gel coat applied to the part being repaired. Use 2 cc MEKP per 100 grams of gel coat. Hand stir for one minute prior to applying to repair area. Fill area and smooth with flat edge of putty knife. Leave slight rounded over-fill to allow for shrinkage of the patch on curved areas. Cover with wax paper or cellophane to exclude air from contact with the surface. Do not work at surface temperatures below 60° F.

Gel Coat Repair (Cont.)

5. When patch is firm and free of exotherm heat, remove wax paper or cellophane. Permit patched area to cure for a minimum of one hour. Wet-sand with 320 grit sandpaper until rough surface of patch is removed. Proceed with 600 grit and wet-sand until smooth.

CAUTION: Always use a sanding block and sand in the same direction. Continue to wet-sand until all shiny edges on patched area have been removed.

6. Wash area with clean acetone.

7. Inspect area for defects. If area is non-porous and free of blemishes, proceed with rubbing compound, liquid polish and wax as outlined in "Marred or Scratched Areas" Steps 3 through 6.

8. Depending upon the degree of surface irregularities, it may be necessary to repeat Steps 4 and 5 or reduce the viscosity of the gel coat consistency and apply with a touch-up gun. This is accomplished by reducing the gel coat with Max. 20% (wt.) styrene monomer. Catalyze mixture with 2% (wt.) MEKP. Apply the reduced mixture on the area to be repaired using a uniform, even spray stroke. Permit 5-10 minutes to set and then topcoat with a water soluble polyvinyl alcohol parting film. When the patch is cured, the PVA film can be removed with tap water. Proceed with Steps 3 through 6 as outlined in "Marred or Scratched Areas."

Repairing Laminate Behind Gel Coat

The following steps should be followed in severe cases in which a defective area extends into the back-up laminate of resin and glass:

Steps

1. With a sharp routing tool, grind out defective area.

CAUTION: Do not leave any undercut edges. Feather in the defective area.

2. Blow out residue with air hose and wash with clean acetone.

3. Build up laminate area with 2 oz. fiberglass mat or equivalent using catalyzed laminating resin common to the original lamination. Apply in an even coat making repair area the same thickness as surrounding laminate. Permit to gel and then knife-trim excess glass and resin.

CAUTION: Build up laminate in stages. Do not build up more than 2 plies of 2 oz. mat at one time to avoid excessive build-up.

4. Permit laminate patch area to cure a minimum of three hours at 70° F.

5. Sand resin and glass area with dry 280 grit sandpaper to remove glass whiskers and provide uniform surface. Blow area clean with air hose followed by a clean acetone wash.

6. Proceed as outlined in "Deeper Defects-Routing" Steps 4 through 7.

Precautions

1. Use the same production batch of Gel coat as used in the original part. It is a good practice to draw off one gallon from the drum being used in production for future repair application. Be sure to agitate prior to drawing off.

2. Damaged area may be too severe to repair in one step and may require stages. Excess coating applied at one time will create excess exotherm heat which will cause the surface to shrink.

3. Let each layer cure prior to applying subsequent layers.

4. Clean with a good quality, clean acetone.

3. Do not use in excess of 2.5% (wt.) or less than 1% (wt.) MEKP in catalyzing the Gel coat for patching purposes.

4. Heat lamps, heat guns or space heater may be used to speed patching process and make repairs in cold working conditions,

CAUTION: Do not overheat. It may cause blistering and poor color matching.

5. Spray patches usually match better than spot patches. In general, keep all patches as small as possible.

6. Additives to the gel coat may cause color changes.

Patching Guide

Problem	Probable Cause
Dull Surface	Requires additional rubbing out with compound.
Low Gloss	Requires additional rubbing out with polish and wax.
Off-Color Patch	Different production batch of gel coat material. Dirty materials and/or equipment. Improper catalyzation. Dirty repair area.
Patch Lift-Off	Improper cleaning and repair.
Wet Patch	Improper catalyst ratio. Temperature too low.
Porosity in Surface	Excess air in gel coat. Water contamination. Application techniques. Patching material too thick.
Scratches/Sanding Marks	Sandpaper grit too course. Dirt or other foreign material on the buffing wheel. Under-cured patch.
Flaking and Cracking	Gel coat material not cured prior to sanding. Improper catalyzation.
Depressed Area	Wet sanding with too small of a sanding block. Sanding with finger as opposed to using sanding block. Excess exotherm on cure. Patch area not properly filled.
Smearred Surface	Acetone not wiped off surface. Contaminated material. Patch not sufficiently cured.
Ring Around Patch	Edges not feathered or sanded properly. Porosity in original gel coat material which may require re-spraying. Under-cured patch.
Reappearing Crack	Crack was not fully ground out. Weak laminate.
Glossy Patch, Dull Part	Original gel coat was under-cured. Buffer developed too much heat.
Porosity or Void in Patch	Improper spray or leveling. Improper mix of filler. Trapped solvent. Air not worked out.
Patch is Below Surface	Not enough allowance for patch shrinkage. Be sure to overfill repair area. Do not sand and finish until patch is cured.

Styrene and Solvents

Misuse, improper handling and exposure to solvents and monomers can cause accidents and health problems. The plant supervisor should be notified of any eye discomfort, breathing difficulty or other physical discomfort.

Styrene monomer and most of the commonly used solvents such as acetone and MEK (methyl ethyl ketone) give off hazardous vapors which can form flammable or explosive concentrations even under normal temperatures. It is imperative these materials be used with good ventilation. Upper and lower explosive limits for styrene monomer by volume of air are 6.1% and 1.1% respectively. When concentrations of styrene fall between these two limits, any ignition source will cause an explosion. Therefore, it is imperative that all sources of ignition be eliminated from areas where solvents or styrene will be used or stored. That includes smoking, welding, burning, hot machinery, open flame and electrical equipment not designed for specific use with these materials.

Flash Point of Styrene

The lowest temperature at which a substance gives off enough vapors to form a flammable mixture with air is the flash point. The flash point of styrene is 31° C. (87.7° F.).

Fire Point of Styrene

In general, fire points are temperatures slightly above those designated at flash points. The fire point is the lowest temperature at which a liquid in an open container will give off enough vapors to continue burning after ignition. The fire point of styrene is 34° C. (93.2 ° F.).

Auto-Ignition of Styrene

Known also as the kindling temperature, the auto-ignition temperature is the lowest temperature at which self-sustained (spontaneous) combustion will occur (without the presence of spark or flame). The auto-ignition temperature of styrene is 490° C. (914° F.).

Styrene Toxicity

Toxicity test results show styrene vapors less toxic than benzene. The characteristic odor along with almost immediate eye/nose irritation gives workers ample warning that styrene vapor is present and that precautions must be taken to reduce exposure. In case of accidental exposure to styrene monomer, call a physician immediately.

Dispensing of Styrene and Solvents

As the fluid is being poured, static electricity can build up creating a potentially explosive accident. To prevent static electricity build-up when transferring solvent from a drum, the drum must be grounded and the receiving container bonded to the drum. Be sure that grounding cables and connectors are attached to clean bare metal surfaces.

Clean-up

Solvent spills must be cleaned up immediately. Compounds such as perlite, vermiculite, clay and sand will absorb solvent.

Storage and Handling

Carry and dispense solvents from safety cans. Take only the amount of solvent to be used during a shift into the work area. Return unused solvent to storage at the end of each shift.

Catalysts

Organic Peroxides

Organic peroxides are usually highly flammable and under certain conditions may decompose with explosive violence. Catalysts have been tested by their manufacturer for heat sensitivity, shock sensitivity, burning rate, flash point, storage stability and reaction to blasting caps to determine their relative hazards.

The material is a strong irritant and corrosive to the eyes. Proper protective equipment must be worn when handling. Obtain manufacturer's material safety data sheets and safe handling and disposal before using.

Mixing

The catalyst must never be added directly to undiluted accelerators or promoters. A violent explosion may result. The best procedure is to first thoroughly mix the accelerator into the resin and then add the catalyst.

Very small quantities of peroxide initiator make drastic changes in the physical properties of polyester resins. It is imperative that all precautions be taken in handling the commercial forms of these products to assure high performance of the initiator and to avoid violent decomposition.

Keep all work areas, tools and containers clean. Avoid mixing peroxides with any substances other than those recommended by the catalyst supplier. Weigh and mix in a special room or area separate from other plant operations. The mix area should be well ventilated and be equipped with sprinklers.

Employees should know the location of the nearest emergency shower and eye wash in the mix area.

Contamination

Contamination is always a potential problem in the handling and use of peroxide catalysts. The most common causes of contamination are exposure to heat and contact with metals. Never expose organic peroxides to heat regardless of the source. This means open flames or sparks, radiators, steam

pipes, or direct sunlight. Any of these exposures may cause the peroxides to decompose explosively and they will burn violently once ignited. Consult manufacturer's recommendations and never exceed recommended storage temperatures.

If a ketone peroxide is heated above a certain temperature, its rate of decomposition increases in an uncontrolled manner. This reaction can become violent, releasing large volumes of hot flammable gases. The temperature at which this occurs depends on the volume, the container and the length of time which the ketone peroxide remains at the temperature. The self-accelerating decomposition temperature (SADT) has been determined to be about 145° F. for methyl ethyl ketone peroxide. Never allow organic peroxides to come in contact with easily oxidized metals or rubbers. Such metals include copper, brass and mild or galvanized steel. Contact with natural and synthetic rubbers is hazardous. When replacement parts are required for equipment designed to handle organic peroxides, follow materials specifications of the equipment manufacturer.

Never mix peroxides in metal containers. Brass, copper, zinc, galvanized finishers and some steels and aluminum alloys are corroded by peroxides and the resulting corrosion can trigger a peroxide fire or explosion.

Equipment designed for contact with ketone peroxides should be limited to 316 stainless steel (304 is an alternate), low and high density polyethylene, glass, and other inert plastic materials like Teflon, Kynar, Nylon and Kel-F. These installations should be adequately grounded, bonded and of approved explosion-proof electrical construction.

Resin or resin over-spray can contaminate equipment used to handle peroxides and create hazardous conditions. If, for example, the funnel used to charge a catalyst pressure pot is contaminated, the amount of promoter present in the funnel could decompose

Catalysts (Cont.)

the peroxide. Grinding dust is also a source of promoters that can decompose peroxides.

Extinguishing Agents

Ketone peroxides burn vigorously and are difficult to extinguish. The usual precautions for flammable liquids should be observed. If a small fire occurs, Class B extinguishers (dry chemical, foam, or carbon dioxide) can be used. In case of fire involving large quantities of ketone peroxides, the area should be evacuated and the fire fought with water.

Fire Extinguishing Agent

Styrene monomer and/or polyester
Dry chemical, water fog, foam or carbon monomer and/or polyester
dioxide

CAUTION: Solvent and/or monomer fire can float on water and therefore can be spread when hit by a direct high pressure stream of water. Never use water or foam to extinguish a fire where electrical equipment is present.

SPRAYING WITH ORGANIC PEROXIDES

Safety Precautions

Keep all equipment clean, with covers in place. Be sure equipment is checked and maintained regularly.

Avoid contaminating the organic peroxide when filling the dispensing containers. Sanding dust and resin over-spray are hazardous sources of contamination. Dispensing containers must be kept away from any sources of fire or heat.

Make sure pressure pot vents are free of all over-spray. Vents clogged with over-spray or vents that are too small will not clean the air adequately. Never test spray into the atmosphere. Always spray into water.

Always duplicate the original construction material when replacement parts become necessary. Replacing screens and other parts with copper or

other metals that are corroded by peroxide can result in fires and explosions.

NEVER SMOKE IN THE SPRAY AREAS. Wear eye protection at all times. Be sure ventilation system is in operation and/or wear a respirator to avoid breathing over-spray. Never point the spray gun at yourself or anyone else.

Storage and Shelf Life

Always store organic peroxides in the manufacturer's original shipping containers. Properly stored ketone peroxides have a limited shelf life. All containers should be dated upon receipt and either used or disposed of within the prescribed time. Store at proper temperature. When measuring or transferring quantities of peroxide, always use clean glass, teflon, polypropylene, polyethylene or stainless steel containers, funnels, stirrers, etc.

Before disposal, containers must be completely emptied and cleaned. **DO NOT REUSE CONTAINERS.** Destroy empty containers following container label instructions.

Keep only the quantity of material that will be used during the operating shift at the work station. Keep all containers labeled and tightly closed to avoid contamination. Organic peroxides must be stored apart from all other materials used in the plant.

Catalysts

DISPOSAL OF ORGANIC PEROXIDES

Organic peroxides must be destroyed. If they are discarded or dumped into sewers they can catch fire or explode.

Spills

Spilled liquid or paste peroxides must be absorbed with sand, clay, perlite, or vermiculite and then wetted down with water. After wetting down, sweep up with non-sparking tools. Sweep solid peroxides with extreme caution. Wet waste should be placed in double polyethylene bags and disposed of as follows:

Disposal of Wet Wastes

Safe destruction of peroxides can be accomplished by slowly adding them to a 5% caustic (lye) solution. Follow your plant's recommended procedures for disposal of diluted solution. When cleaning up use only clean, white rags. Dyes used in colored rags may react with peroxides. Contaminated rags and single-use containers and tools may be disposed of by burning in a property designated incinerator which has been permitted by local environmental

authorities, or by soaking them in water. Follow your plant's recommended procedures.

Dusts

Dusts from flashing removal, finishing operations, sanding joints or repairing defects can irritate the skin, nose, throat and lungs. The plant's finishing areas should be equipped with exhaust booths or equipment with vacuum dust collection devices. Depending on the effectiveness of this equipment, dust respirators may still be necessary. Dust respirators must be worn where there are no dust collection devices available. Long sleeved shirts will reduce exposure to skin.

CAUTION: A source of many explosions has been dust from cutting, grinding, etc. which sifts into catalyst pots through the vent and during filling. This dust contains cobalt compounds from the promoter system which causes decomposition of peroxides. The best way to eliminate this problem is to eliminate the catalyst pot altogether and use positive displacement catalyst injection equipment.